

Having thus described the preferred embodiments, the invention is now claimed to be:

1. An apparatus (100) for depth ordering of parts of one or more digital images comprising:

an input section (110) for receiving the digital images;

a first regularization means (130) for regularizing image features of the digital images, composed of pixels, by segmentation, including assigning means (130) for assigning at least part of the pixels of the images to respective segments;

a first estimating means (140) for estimating relative motion of the segments for successive images by image matching;

a second regularization means (150) for regularizing image features of the segments by dual segmentation, including a means (150) for finding the edges of the segments, an assigning means (150) for assigning pixels to the edges, and a means (150) for creating dual segments;

a second estimating means (160) for estimating relative motion of the dual segments for successive images by image segment matching to determine relative depth order of the image segments.

an output section (170) for outputting relative depth ordering of parts of the images.

2. The apparatus (100) for depth ordering of parts of one or more digital images as set forth in claim 1, wherein the digital images include frames of a two-dimensional video sequence.

3. The apparatus (100) for depth ordering of parts of one or more digital images as set forth in claim 1, wherein the first estimating means (140) includes

a defining means (140) for defining a finite set of candidate values wherein a candidate value represents a candidate for a possible match between image features of two or more images;

an establishing means (140) for establishing a matching penalty function for evaluation of the candidate values;

a selecting means (140) for selecting a candidate value based on the result of the evaluation of the matching penalty function.

4. The apparatus (100) for depth ordering of parts of one or more digital images as set forth in claim 1, wherein the dual segments are defined by taking a pixel along the border of two neighboring segments as seed pixels, and assigning parts of the remaining pixels to one of the seeds using a distance transform algorithm.

5. The apparatus (100) for depth ordering of parts of one or more digital images as set forth in claim 1, wherein the second estimating means (160) includes
a calculating means (160) for calculating optimal motion vectors for the dual segments;

a computing means (160) for computing match penalties for the dual segments;

a selecting means (160) for selecting a closer segment by comparing the optimal motion vectors.

6. A display apparatus (200) comprising the apparatus (100) as set forth in claim 1.

7. A method for relative depth ordering of parts of one or more digital images, the method including:

providing one or more digital images;

regularizing image features of the digital images, composed of pixels, by segmentation, including assigning at least part of the pixels of the images to respective segments;

estimating relative motion of the segments for successive images by image matching;

further regularizing image features of the segments by dual segmentation, including finding the edges of the segments, assigning pixels to the segments, and defining dual segments;

estimating relative motion of the borders of the dual segments for successive images by image segment matching to determine relative depth order of parts of the images.

8. The method for depth ordering of parts of one or more digital images as set forth in claim 7, wherein the digital images include frames of a two-dimensional video sequence.

9. The method for depth ordering of parts of one or more digital images as set forth in claim 7, wherein estimating the relative motion of the segments includes

defining a finite set of candidate values wherein a candidate value represents a candidate for a possible match between image features of two or more images;

establishing a matching penalty function for evaluation of the candidate values;

selecting the candidate value based on the result of the evaluation of the matching penalty function.

10. The method for depth ordering of parts of one or more digital images as set forth in claim 7, wherein the dual segmentation is achieved by means of quasi segmentation, where for each pair of neighboring segments a seed is defined consisting of those pixels which belong to one of the segments and at least one of its neighbors belongs to the other segment, and where at least parts of the other pixels in the images are assigned to that seed to which their distance is smallest

11. The method for depth ordering of parts of one or more digital images as set forth in claim 7, wherein estimating relative motion of the borders of the dual segments includes

calculating optimal motion vectors for the dual segments;

computing match penalties for the dual segments;

selecting a closer segment by comparing the optimal motion vectors.

12. Computer program for enabling a processor to carry out the method for depth ordering of parts of one or more digital images as set forth in claim 7.

13. Tangible medium carrying the computer program as set forth in claim 12.

14. Specific hardware for enabling a processor to carry out the method for depth ordering of parts of one or more digital images as set forth in claim 7.

15. Reconfigurable hardware for enabling a processor to carry out the method for depth ordering of parts of one or more digital images as set forth in claim 7.